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## (54) POLYLACTIC ACID-BASED RESIN COMPOSITION AND PREPARATION THEREOF

### (57)Abstract:

PROBLEM TO BE SOLVED: To obtain a composition improved in flexibility and melt tension and excellent in molding processability by compounding a polylactic acid having a specific weight-average mol.wt., an aliphatic polyester having a specific weight-average mol.wt. and an organic peroxide.

SOLUTION: This composition is obtained by melt-kneading 100 pts.wt. of polylactic acid having a weight-average mol.wt. of 30,000-500,000, 10-300 pts.wt. of an aliphatic polyester having a weight-average mol.wt. of 30,000-500,000, an elastic modulus of 50-1,000 MPa and an elongation of 20-2,000% and 0.01-5 pts.wt. of an organic peroxide at 150-250°C. The composition has a melt tension of 0.7-20 g when a melt flow index thereof is 10 g/10 min, an elastic modulus of 50-1,500 MPa and an elongation of 100-2,000%. As the aliphatic polyester, there can be exemplified polycaprolactone, polybutylene succinate, polyethylene succinate and the like. As the organic peroxide, there can be mentioned ketone peroxide compounds, hydroperoxide compounds, dialkyl peroxides and the like.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a polylactic acid system resin constituent. It is related with the approach of furthermore obtaining a polylactic acid system resin constituent.

[0002]

[Description of the Prior Art] Generally resin, such as polyethylene, polypropylene, plasticized polyvinyl chloride, and polyethylene terephthalate, is mentioned as resin excellent in flexibility, thermal resistance, and a water resisting property, engine performance, such as a light weight, adiathermic, soundproofing, and cushioning properties, is employed efficiently, and the rear-spring-supporter activity is carried out at other fields. However, the recovery and reuse after an activity are difficult for these resin, and since it is hardly decomposed under natural environment, it remains in the earth semipermanently. Moreover, the scene was spoiled by the abandoned plastics and the problem of the living environment of a marine organism being destroyed has arisen by it.

[0003] On the other hand, the aliphatic series polyester guided from the lactic-acid system polymer, aliphatic series polyhydric alcohol, and aliphatic polycarboxylic acid of polylactic acid and a lactic acid, and other aliphatic series hydroxycarboxylic acid, such as a copolymer, is developed as a polymer which has biodegradability with thermoplastics. In these polymers, when it biodegrades 100% within one year from several months in the body of an animal or is placed all over soil or seawater, under the damp environment, decomposition is begun in several weeks and it will disappear from about one year in several years. Furthermore, the decomposition product has the property of becoming a lactic acid and a carbon dioxide harmless to the body, and water.

[0004] Amplification of the field of the invention is expected from especially polylactic acid having the description in which the L-lactic acid of a raw material was [ nature / resistance / as opposed to / a large quantity and having come to be manufactured cheaply, and the catabolic rate in the inside of a compost are quick, and / mold /, / the scenting-proof nature to food, coloring-proof nature ] excellent with bacterial coupling in recent years. However, since rigidity of polylactic acid is high, it is hard to call it the suitable resin for the application as which flexibility, such as a film and a packing material, is required, and the technique which blends with other biodegradability resin and is elasticity-ized is known. As such resin, polybutylene succinate, polyethylene succinate, the poly caprolactone, etc. are mentioned, for example, and it is indicated by JP,8-245866,A and JP,9-111107,A.

[0005] However, in a mere blend, about the elongation of what can carry out [ elasticity ]-izing (that is, an elastic modulus can be \*\*(ed) low), it can hardly improve, but the fault which is easy to go out of being easy to be torn will remain. Furthermore, generally, since melting tension is low, as for polylactic acid, the point inadequate for inflation molding and the shaping approach like lamination shaping is left behind. That is, since there is not sufficient melting tension in case melting shaping is carried out, it is the trouble that the neck in is large in being easy to be torn during shaping.

[0006] As an approach of raising melting tension, it can consider making a polymer fine-construct a bridge. It considers as the approach of making a polymer fine-constructing a bridge, and there is an

approach using organic peroxide. The example which carries out reaction extrusion of the organic peroxide to WO 95/No. (Patent Publication Heisei No. 501560 [ ten to ]) 18169 official report or a U.S. Pat. No. 5594095 official report to polylactic acid is indicated. However, even if it makes a bridge fine-construct using organic peroxide to polylactic acid, although melting tension improves, rigidity and an elastic modulus are still high, and elongation is not improved, either, and the object of this invention cannot be attained.

[0007] With the class or amount, the approach of adding a plasticizer and giving flexibility has the problem of bleed out, and cannot be said to be the approach of not necessarily satisfying depending on an application. Thus, the actual condition is that a technique which it improves [ technique ] and raises the flexibility of polylactic acid further also as for melting tension was not found out until now.

[0008]

[Problem(s) to be Solved by the Invention] It is offering the polylactic acid system resin constituent which flexibility and melting tension of the technical problem which this invention's tends to solve improve, and has the outstanding fabricating-operation nature, and the manufacture approach.

[0009]

[Means for Solving the Problem] this invention persons came to complete a header and this invention for the polylactic acid of a specific rate, aliphatic series polyester, the polylactic acid system resin constituent with which are satisfied of the above-mentioned technical problem elongation and whose melting tension improved by making organic peroxide reacting within an extruder, and the manufacture approach, as a result of examining polylactic acid wholeheartedly. That is, this invention is specified according to the matter indicated to the following [1] - [13].

[0010] [1] Polylactic acid [a component (a-1)] and aliphatic series polyester [the resinous principle [(A) component which comes to contain component (a-2)]], It is the polylactic acid system resin constituent obtained by carrying out melting kneading of the organic peroxide component [(B) Component] in a 150-250-degree C temperature requirement. The presentation ratio of polylactic acid [a component (a-1)] and aliphatic series polyester [a component (a-2)] and organic peroxide component [(B) component] is based on the polylactic acid [component (a-1)] 100 weight section. aliphatic series -- polyester -- [ -- a component (a-2) -- ] -- ten - 300 -- weight -- the section -- organic peroxide -- a component -- [ -- ( -- B -- ) -- a component -- ] -- 0.01 - five -- weight -- the section -- it is -- Polylactic acid [a component (a-1)] is weight average molecular weight 30,000-Mw 500,000. The polylactic acid system resin constituent with which aliphatic series polyester [a component (a-2)] is characterized by being weight average molecular weight 30,000-Mw 500,000, an elastic modulus 50 - 1000MPa, and 20 - 2,000% of elongation.

[0011] [2] The polylactic acid system resin constituent which is at least one sort chosen from the group which aliphatic series polyester [a component (a-2)] becomes from the copolymer of the poly caprolactone, polybutylene succinate, polyethylene succinate, and a hydroxybutyric acid and a hydroxy valeric acid and which was indicated to [1].

[3] For 0.7-20 [g], and \*\* elastic modulus, 50-1,500 [MPa], and \*\* elongation are [ the melting tension in the \*\* melt flow index 10 [g / 10 minutes] ] 100-2,000 [%].

The polylactic acid system resin constituent which comes out and exists and which was indicated to [1] or [2].

[0012] [4] Polylactic acid [a component (a-1)] and aliphatic series polyester [the resinous principle [(A) component which comes to contain component (a-2)]], It is the manufacture approach of the polylactic acid system resin constituent which carries out melting kneading of the organic peroxide component [(B) Component] in a 150-250-degree C temperature requirement. The presentation ratio of polylactic acid [a component (a-1)] and aliphatic series polyester [a component (a-2)] and organic peroxide component [(B) component] is based on the polylactic acid [component (a-1)] 100 weight section. aliphatic series -- polyester -- [ -- a component (a-2) -- ] -- ten - 100 -- weight -- the section -- organic peroxide -- a component -- [ -- ( -- B -- ) -- a component -- ] -- 0.01 - five -- weight -- the section -- it is -- Polylactic acid [a component (a-1)] is weight average molecular weight 30,000-Mw 500,000. The manufacture approach of a polylactic acid system resin constituent that aliphatic series polyester [a component (a-2)] is characterized by being weight average molecular weight 30,000-Mw 500,000, an

elastic modulus 50 - 1000MPa, and 20 - 2,000% of elongation.

[0013] [5] The manufacture approach of the polylactic acid system resin constituent indicated to [4] which is at least one sort chosen from the group which aliphatic series polyester [a component (a-2)] becomes from the copolymer of the poly caprolactone, polybutylene succinate, polyethylene succinate, and a hydroxybutyric acid and a hydroxy valeric acid.

[6] The manufacture approach of the polylactic acid system resin constituent which the melting tension in the \*\* melt flow index 10 [g / 10 minutes] indicated to [4] whose range and \*\* elongation of 50-1,500 [MPa] 0.7-20 [g], and \*\* elastic modulus are 100-2,000 [%], or [5].

[0014] [7] Mold goods which come to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[8] The film which comes to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[9] The tubular blown film which comes to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[0015] [10] Foam which comes to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[11] The layered product which is a layered product which comes to contain a resin layer and a base material layer, and is the thing in which said resin layer comes to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[12] The paper lamination product which is a paper lamination product which comes to contain a resin layer and paper, and is the thing in which said resin layer comes to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[13] The aluminum lamination product which is an aluminum lamination product which comes to contain a resin layer and an aluminum layer, and is the thing in which said resin layer comes to contain the polylactic acid system resin constituent indicated they to be [ any of [1] thru/or [3] ].

[0016]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail.

The range of the weight average molecular weight Mw of the polylactic acid in [molecular weight of polylactic acid] this invention is 30,000-500,000. desirable -- 50,000-300,000 -- it is the range of 100,000-200,000 more preferably. Molecular weight may be low and less than 50,000 may not be enough as a mechanical strength. When 500,000 was exceeded and crosslinking reaction advances, molecular weight becomes high too much and a fabricating operation may become difficult.

[0017] In [manufacture approach of polylactic acid] this invention, L-lactic acid, D-lactic acid, DL-lactic acids, those mixture, or the lactide that is the annular dimer of a lactic acid can be mentioned as an example of the lactic acid which is the raw material of polylactic acid.

[0018] As an example of the manufacture approach of the polylactic acid used in this invention For example, mixture of a \*\* lactic acid or a lactic acid, and aliphatic series hydroxycarboxylic acid is used as a raw material. How to carry out a direct dehydration polycondensation (for example, the manufacture approach shown in U.S. Pat. No. 5,310,865), \*\* The ring-opening-polymerization method which carries out the melting polymerization of the annular dimer (lactide) of a lactic acid (For example, the manufacture approach currently indicated by the U.S. Pat. No. 2,758,987 number), \*\* The annular dimer of a lactic acid and aliphatic series hydroxycarboxylic acid, for example, lactide and glycolide, and epsilon-caprolactone The ring-opening-polymerization method which carries out a melting polymerization under existence of a catalyst (for example, the manufacture approach currently indicated by the U.S. Pat. No. 4,057,537 number), \*\* The approach (for example, the manufacture approach currently indicated by U.S. Pat. No. 5,428,126), [0019] which carry out the direct dehydration

polycondensation of the mixture of a lactic acid, and an aliphatic series dihydric alcohol and an aliphatic series dibasic acid \*\* It faces manufacturing a polyester polymer by performing a dehydration polycondensation reaction for the approach (for example, Europe patent official report the 0712880 A the manufacture approach currently indicated by No. 2) and \*\* lactic acid which condense the polymer of polylactic acid, aliphatic series dihydric alcohol, and an aliphatic series dibasic acid under organic

solvent existence under existence of a catalyst, and although the approach of performing solid state polymerization at some [ at least ] processes etc. can be mentioned, it is not limited to especially the manufacture approach. Moreover, polyhydric alcohol, such as aliphatic series polyhydric alcohol like a small amount of glycerol, aliphatic series polybasic acid like butane tetracarboxylic acid, and polysaccharide, may be made to live together, and copolymerization may be carried out, and molecular weight may be raised using binders (macromolecule chain elongation agent), such as a diisocyanate compound.

[0020] The aliphatic series polyester in [aliphatic series polyester] this invention is a polymer which has the biodegradability which can be manufactured combining various aliphatic series hydroxycarboxylic acid, aliphatic series dihydric alcohol, and aliphatic series dibasic acids. Also in these, especially the copolymer of the poly caprolactone, polybutylene succinate, polyethylene succinate, and a hydroxybutyric acid and a hydroxy valeric acid is desirable. Although the manufacture approach of polylactic acid and the same approach can also be used as the manufacture approach of aliphatic series polyester, it is not limited to the approach. What is marketed may be used, for example, cel green (a trade name, Daicel Chemical Industries make), a tone (a trade name, made in Union Carbide), Bionolle (a trade name, Showa High Polymer make), the biotechnology pole (a trade name, Monsanto make), etc. may be used.

[0021] Moreover, a polymer chain may be extended with binders, such as diisocyanate, and these aliphatic series polyester may make polyhydric alcohol, such as aliphatic series polyhydric alcohol like a small amount of glycerol, aliphatic series polybasic acid like butane tetracarboxylic acid, and polysaccharide, live together, and may carry out copolymerization.

[0022] The aliphatic series polyester in [flexibility of aliphatic series polyester] this invention requires that an elastic modulus should be [ 50-1000MPa and elongation ] 20 - 2000% in the tension test of the film mentioned later. An elastic modulus is 50-500MPa more preferably, and sufficient flexibility will not be acquired if 1000MPa is exceeded. Elongation is 200 - 2000% still more preferably 100 to 2000% more preferably, and sufficient flexibility is not acquired in the resin constituent of this invention at less than 20%.

[0023] As an example of [aliphatic series hydroxycarboxylic acid] aliphatic series hydroxycarboxylic acid, a glycolic acid, 3-hydroxybutyric acid, 4-hydroxybutyrate, a 3-hydroxy valeric acid, a 4-hydroxy valeric acid, a 6-hydroxy caproic acid, etc. can be mentioned, and epsilon-caprolactone which is the cyclic ester of aliphatic series hydroxycarboxylic acid, for example, the cyclic ester of glycolide or a 6-hydroxy caproic acid which is the dimer of a glycolic acid, can be mentioned further, for example. These are independent, or they can be used, combining them two or more sorts.

[0024] As an example of [aliphatic series dihydric alcohol] aliphatic series dihydric alcohol, ethylene glycol, diethylene-glycol, triethylene glycol, polyethylene-glycol, propylene glycol, dipropylene glycol, 1,3-butanediol, 1,4-butanediol, 3-methyl-1,5-pentanediol, 1, 6-hexanediol, 1, 9-nonane diol, neopentyl glycol, polytetramethylene glycol, 1, 4-cyclohexane dimethanol, 1, and 4-benzene dimethanol etc. is mentioned, for example. these -- independent -- or two or more sorts -- it can be combined and used.

[0025] As an example of a [aliphatic series dibasic-acid] aliphatic series dibasic acid, succinic-acid, oxalic acid, malonic-acid, glutaric-acid, adipic-acid, pimelic-acid, suberic-acid, azelaic-acid, sebacic-acid, undecane diacid, dodecane diacid, phenyl succinic-acid, 1, and 4-FENI range acetic acid etc. is mentioned, for example. These are independent or can be used in two or more sorts of combination.

[0026] The range of the weight average molecular weight Mw of the aliphatic series polyester in [molecular weight of aliphatic series polyester] this invention is 30,000-500,000. desirable -- 50,000-300,000 -- it is the range of 100,000-200,000 more preferably. Molecular weight may be low and less than 30,000 may not be enough as a mechanical strength. When 500,000 was exceeded and crosslinking reaction advances, molecular weight becomes high too much and a fabricating operation may become difficult.

[0027] The polylactic acid (a1) in [presentation ratio of macromolecule component] this invention and the presentation ratio of aliphatic series polyester (a2) are the range of aliphatic series polyester (a2) 10 - the 300 weight sections to the polylactic acid (a1) 100 weight section. desirable -- the 30 - 200 weight

section -- it is the range of the 50 - 100 weight section more preferably. Flexibility may become imperfection under in 10 weight sections. If the 300 weight sections are exceeded, the thermal resistance of a polylactic acid system resin constituent may be spoiled.

[0028] Especially as organic peroxide used by [class of organic peroxide] this invention, although not limited, a ketone peroxide system compound, a diacyl peroxide system compound, a hydroperoxide system compound, a dialkyl peroxide system compound, a peroxy ketal system compound, a peroxy ester system compound, a peroxy carbonate system compound, etc. are mentioned.

[0029] As a ketone peroxide system compound, methyl ethyl ketone peroxide, methyl-isobutyl-ketone peroxide, cyclohexanon peroxide, methylcyclohexanone peroxide, etc. are mentioned, for example. As a diacyl peroxide system compound, isobutyryl peroxide, 3 and 5, 5-trimethylhexanoyl peroxide, lauroyl peroxide, benzoyl peroxide, p-chlorobenzoyl peroxide, etc. are mentioned.

[0030] As a hydronium peroxide system compound, t-butyl hydroperoxide, cumene hydroperoxide, diisopropylbenzene hydronium peroxide, p-menthane hydroperoxide, 1,1,3,3-tetramethylbutyl hydroperoxide, etc. are mentioned, for example.

[0031] As a dialkyl peroxide system compound For example, di-t-butyl peroxide, t-butyl-alpha-cumyl peroxide, G alpha-cumyl peroxide, 1, 4-bis(t-butyl dioxy) (isopropyl) benzene, 1, 3-bis(t-butyl dioxy) (isopropyl) benzene, 2, the 5-dimethyl -2, 5-bis(tert-butyl peroxide) benzene, 2, the 5-dimethyl -2, a 5-bis(tert-butyl peroxide) hexane, 2, the 5-dimethyl -2, 5-bis(tert-butyl peroxide) hexyne, etc. are mentioned.

[0032] As a peroxy ketal system compound, it is 1 and 1-screw (tert-butyl peroxide). - 3, 3, 5-trimethylcyclohexane, n-butyl -4, 4-bis(tert-butyl peroxide) valerate, 2, and 2-bis(tert-butyl peroxide) butane etc. is mentioned.

[0033] As an alkyl par ester system compound, t-butyl peroxyacetate, t-buthylperoxy isobuthylate, t-butyl peroxyoctoate, t-butylperoxy perpivalate, t-butylperoxy neodecanoate, t-butylperoxy-3,5,5-trimethyl hexanoate, t-butyl peroxybenzoate, t-butyl peroxy laurate, 2, the 5-dimethyl -2, a 5-bis (benzoylperoxy) hexane, etc. are mentioned.

[0034] As a peroxy carbonate system compound, screw-(2-ethylhexyl) peroxy dicarbonate, diisopropyl peroxy dicarbonate, di-sec-butyl peroxydicarbonate, di-n-propyl peroxy dicarbonate, bis(3-methoxy butyl) peroxy dicarbonate, bis(2-ethoxyethyl) peroxy dicarbonate, bis(4-t-butyl cyclohexyl) peroxy dicarbonate, OO-t-butyl-O-isopropyl peroxy carbonate, etc. are mentioned. Succinic acid peroxide etc. is mentioned as other organic peroxide. These may be used independently, or two or more kinds may be mixed and they may be used.

[0035] Although the addition of [addition of organic peroxide] organic peroxide is based also on the class and reaction temperature, it is the range of 0.01 - 5 weight section to the macromolecule component 100 weight section. desirable -- 0.05 - 3 weight section -- it is the range of 0.1 - 2 weight section more preferably. Under the 0.01 weight section is not enough as the effectiveness as a cross linking agent. If 5 weight sections are exceeded, viscosity becomes high too much and melting shaping of it may not be able to be carried out.

[0036] The elastic modulus of the film which consists of a polylactic acid system resin constituent obtained by [flexibility] this invention is the range of 50-1500MPa. The elastic modulus and elongation of this invention are the numeric values acquired by the approach of mentioning later.

[0037] The range of the melting tension of the polylactic acid system resin constituent obtained by [melting tension] this invention is 0.7-20g. Since less than 0.7g of melting tension is not enough, the workability ofg is inadequate. If it exceeds 20g, depending on the case, it may actually be hard coming to carry out melting shaping. The melting tension of this invention is the numeric value acquired by the approach of mentioning later.

[0038] Polylactic acid, aliphatic series polyester, and organic peroxide are blended, and melting kneading is carried out and it is made to react within a melting kneading machine in [melting kneading] this invention.

[0039] Although the melting kneading temperature in [melting kneading temperature] this invention is based also on the presentation ratio of the class of aliphatic series polyester to be used, and polylactic

acid and aliphatic series polyester, and the class and addition of organic peroxide, the range of it is usually 150-250 degrees C. more -- desirable -- the range of 160-230 degrees C -- it is the range of 170-200 degrees C most preferably. At less than 150 degrees C, resin may not fuse but kneading may be impossible. If it exceeds 250 degrees C, resin will decompose, and the case where molecular weight falls greatly, and a reaction advance too much, and may gel.

[0040] Although the melting mixing time in [melting mixing time] this invention is based also on the melting kneading machine to be used or melting kneading temperature, it is usually about 0.01 - 15 minutes.

[0041] In [other additive] this invention, if the object is not spoiled, lubricant, a filler, a coloring agent, a plasticizer, an ultraviolet ray absorbent, an antioxidant, a flame retarder, an internal release agent, an antistatic agent, a surface wetting improvement agent, an incineration adjuvant, a pigment, lubricant, etc. may be added.

[0042] Preliminary mixing of the [manufacture approach] polylactic acid, aliphatic series polyester, organic peroxide, and the other additives is carried out using a mortar, a Henschel mixer, a drum blender, a tumbler blender, a ball mill, a ribbon blender, etc., and melting kneading is subsequently usually carried out by a well-known 1 shaft extruder, a twin screw extruder, a melting kneading machine, a Banbury mixer, Brabender, plastograph, the hot calender roll, a kneader, etc. Moreover, organic peroxide and other additives are the approaches that the approach of supplying using the side feeder of an extruder etc. is also desirable.

[0043] In [moisture etc. this inventions], when the effectiveness of a reaction and the thermal stability of resin are taken into consideration, the content moisture content of resin is set to 1,000 ppm or less, and it is desirable to carry out melting kneading.

The example of an application of the polylactic acid system resin constituent concerning this invention is given to \*\* below [the example of an application] - \*\*.

\*\* Mold goods which come to contain a polylactic acid system resin constituent.

\*\* The film which comes to contain a polylactic acid system resin constituent.

\*\* The tubular blown film which comes to contain a polylactic acid system resin constituent.

\*\* Foam which comes to contain a polylactic acid system resin constituent.

\*\* The layered product said whose resin layer it is the layered product which comes to contain a resin layer and a base material layer, and is the thing which comes to contain a polylactic acid system resin constituent.

\*\* The paper lamination product said whose resin layer it is the paper lamination product which comes to contain a resin layer and paper, and is the thing which comes to contain a polylactic acid system resin constituent.

\*\* The aluminum lamination product said whose resin layer it is the aluminum lamination product which comes to contain a resin layer and an aluminum layer, and is the thing which comes to contain a polylactic acid system resin constituent.

[0044] Although especially the fabricating-operation method of the aliphatic series polyester obtained by [fabricating-operation method and application] this invention is not restricted, specifically, the molding processing methods, such as injection molding, extrusion molding, inflation molding, extrusion blow molding, foaming, calender shaping, blow molding, balun shaping, a vacuum forming, and spinning, are mentioned. This polyester by the suitable fabricating-operation method Moreover, for example, the member of writing materials, such as a ball-point mechanical pencil and a pencil, The member of stationery, the tee for golf, the member for fume golf balls for the opening ceremonies, The capsule for oral drugs, the anus and the support for vaginas for suppositories, the skin and support for membrane for agents with tension, The capsule for agricultural chemicals, the capsule for fertilizer, the capsule for seeds and saplings, compost, the spool for fishing lines, The float for fishing, the lure for fishings, lure, the buoy for fishings, the decoy for hunting, the buckshot capsule for hunting, Camping outfits, such as tableware, a nail, a pile, union material, skid mud and material for snowy roads, A block, a lunch box, tableware, the container of lunch which is sold at a convenience store, or a daily dish, Chopsticks, half-split chopsticks, a fork, a spoon, a skewer, a toothpick, the cup of a cup rahmen, A cup which is used

with the automatic vending machine of a drink, a fresh fish, prime meat, vegetables and fruits, tofu, TOROBAKO which is used in the container and tray for food, such as a daily dish, and a fresh fish commercial scene, The bottle for soft drink, such as a bottle for dairy products, such as cow's milk, yogurt, and a lactic acid bacteria beverage, and a carbonated drink, a soft drink, The bottle for alcoholic beverage drinks, such as Biel whiskey, with [ for a shampoo or liquid soap ] a pump, Or a bottle without a pump, the tube for gear-tooth polishing powder, a cosmetics container, a detergent container, Casing, such as casing of a bleaching agent container, a heat insulation box, a flowerpot, and a water-purifier cartridge, an artificial kidney, and an artificial liver, It can be used for the shock absorbing material for using it at the time of transport of ceramics, such as shock absorbing material for using it at the time of transport of precision instruments, such as shock absorbing material for using it at the time of transport of electrical home appliances, such as a member of a glass syringe, television, and a stereo, and a computer printer, a clock, and glass, pottery, etc.

[0045] The lactic-acid system resin constituent concerning [lactic-acid system resin constituent] this invention has the description of being hard to color it polysaccharide compared with the polymer which added the amount side chain of resolvability macromolecules. The lactic-acid system resin constituent concerning this invention has the description of having the high transparency more than an EQC, compared with usual aliphatic series polyester. The lactic-acid system resin constituent concerning this invention has the description that melting tension is notably large, compared with usual aliphatic series polyester. It enabled fabricating-operation nature to be improved greatly and to manufacture the moldings of various classes by this.

[0046] The lactic-acid system resin constituent of this invention can obtain the class of hydroxycarboxylic acid which is the constituent of a side chain, and the lactic-acid system resin constituent of the physical properties of a request with a presentation. Under the present circumstances, a homopolymer (homopolymer) or a copolymer (copolymer) is sufficient as the polyhydroxy carboxylic acid (polymer of hydroxycarboxylic acid) component which constitutes the side chain, and, in the case of a copolymer, any of a random copolymer, a change copolymer, a block copolymer, and a graft copolymer are sufficient as that array format. Moreover, especially the structure of the polyhydroxy carboxylic acid which constitutes the side chain may not be restricted, but a line or the letter of branching is sufficient as it. Moreover, the lactic-acid system resin constituent of this invention has the structure which connected the star type giant molecules as for which the amount side chain of resolvability giant molecules (polyhydroxy carboxylic acid) was added and made to the polyfunctional core compound (the aliphatic polycarboxylic acid which has three or more carboxyl groups, and/or its acid anhydride) with the aliphatic series polyhydric alcohol which has two or more hydroxyl groups, and is considered by this that the above-mentioned high melting tension was discovered.

[0047] The detail of the methodology of [melting tension] melting tension assessment for example, a "plastics-processing-technology handbook" (edit; -- the Society of Polymer Science, Japan --) Issuance; Nikkan Kogyo Shimbun, and the 1995 term of 1414-1416 pages "(2) melting tension", "PROPERTIES OF POLYMERS - THEIR CORRELATION WITH CHEMICAL STRUCTURE;THEIR NUMERICAL ESTIMATION AND PREDICTION FROM ADDITIVE GROUP CONTRIBUTIONS - THIRD, COMPLETELY REVISED EDITION" (author; D.W.VAN KREVELEN, issuance;ELSEVIER, 1990) It is indicated by 686-687 etc. pages etc.

[0048] With a melting tension measuring device, melting tension is tension required in order to extend to a fixed yarn diameter, and measures the strand extruded from the melt indexer with constant speed with the test temperature corresponding to a actual molding temperature. Generally, if melting tension is large, it will be good in the bubble stability in inflation molding, and the drawdown in blow molding will become small. Moreover, although there is a neck-in phenomenon in which the film width used as the product in a sheet and cast film shaping becomes narrower than die outlet width of face, this amount of necks in also has the close relation to melting tension. The melting tension of the lactic-acid system resin constituent concerning this invention is controllable to a desired thing by choosing the numeric value of an invention specification matter. When a melt flow index is measured in two suitable temperature, the temperature to which a melt flow index becomes 10g / 10 minutes from a temperature-

melt-flow-index-plot is searched for using 2160g of loads and melting tension is measured in the temperature, the value of a thing 0.7g or more is [ the melting tension of the lactic-acid system resin constituent concerning this invention ] desirable.

[0049] The lactic-acid system resin constituent concerning [application of lactic-acid system resin constituent] this invention can be suitably used before this application as an alternative of the medical-application way and food package application which were well-known and official business, or the resin currently used general-purpose.

[0050] Although especially the fabricating-operation method of the lactic-acid system resin constituent concerning [fabricating-operation method of lactic-acid system resin constituent concerning this invention] this invention is not restricted, injection molding, extrusion molding, inflation molding, extrusion blow molding, foaming, calender shaping, blow molding, balun shaping, spinning, etc. are desirable, and, specifically, inflation molding, blow molding, extrusion blow molding, foaming, and especially spinning are desirable especially. This lactic-acid system resin constituent by the suitable fabricating-operation method Moreover, for example, the member of writing materials, such as a ball-point mechanical pencil and a pencil, The member of stationery, the tee for golf, the member for fume golf balls for the opening ceremonies, The capsule for oral drugs, the anus and the support for vaginas for suppositorys, the skin and support for membrane for agents with tension, The capsule for agricultural chemicals, the capsule for fertilizer, the capsule for seeds and saplings, compost, the spool for fishing lines, It can be suitably used also as camping outfits, such as the float for fishing, the lure for fishings, lure, a buoy for fishings, a decoy for hunting, a buckshot capsule for hunting, and tableware, a nail, a pile, union material, skid mud and the material for snowy roads, a block, etc.

[0051] The lactic-acid system resin constituent concerning this invention by the suitable fabricating-operation method For example, a lunch box, tableware, the container of lunch which is sold at a convenience store, or a daily dish, Chopsticks, half-split chopsticks, a fork, a spoon, a skewer, a toothpick, the cup of a cup rahmen, A cup which is used with the automatic vending machine of a drink, a fresh fish, prime meat, vegetables and fruits, tofu, TOROBAKO which is used in the container and tray for food, such as a daily dish, and a fresh fish commercial scene, The bottle for soft drink, such as a bottle for dairy products, such as cow's milk, yogurt, and a lactic acid bacteria beverage, and a carbonated drink, a soft drink, The bottle for alcoholic beverage drinks, such as Biel whiskey, a pump, the bottle without a pump for a shampoo or liquid soap, The tube for gear-tooth polishing powder, a cosmetics container, a detergent container, a bleaching agent container, a heat insulation box, Casing, such as casing of a flowerpot and a water-purifier cartridge, an artificial kidney, and an artificial liver, The shock absorbing material for using it at the time of transport of electrical home appliances, such as a member of a glass syringe, television, and a stereo, It can be suitably used also as shock absorbing material for using it at the time of transport of ceramics, such as shock absorbing material for using it at the time of transport of precision instruments, such as a computer printer and a clock, and glass, pottery.

[0052] The lactic-acid system resin constituent concerning manufacture of a film or a sheet and [film production] this invention fits processing which requires the reinforcement of the polymer fused [ extrusion molding / blow molding, foaming, ]. For example, in the case of the sheet by extrusion molding, there is the description that little the sheet by which melting's was carried out hanging down, and reduction of the sheet width by the neck in are.

\*\* The film and sheet containing the lactic-acid system resin constituent concerning manufacturing-technology this invention can be manufactured with techniques, such as the extrusion method of well-known and official business, the co-extruding method, the calender method, hot pressing, the solvent casting method, a tubular film process, a balloon method, and the tenter method. Manufacture conditions are set up in consideration of the thermal property of the lactic-acid system resin constituent with which manufacture is presented, the molecular structure, crystallinity, etc.

[0053] \*\* an additive additive (an antioxidant, a thermostabilizer, UV stabilizer, and lubricant --) Suitably a bulking agent, an antibonding agent, an antistatic agent, a surface wetting improvement agent, an incineration adjuvant, a slipping inhibitor, a pigment, etc. by choosing [ for the purpose of extrusion conditions, drawing conditions, etc. ] The film and sheet containing the lactic-acid system resin

constituent concerning this invention which has properties, such as desired physical properties, gas barrier property, an optical property, a transmitted light wavelength spectrum, protection-from-light nature, and oilproof, can be manufactured.

\*\* a process-planning production process -- setting -- a uniaxial-stretching scale factor, a biaxial-stretching scale factor, a drawing number of stages, heat treatment temperature, the change rate of heat treatment temperature, the number of cooling rollers, the arrangement format of a cooling roller, and a cooling roller -- it can twist and can set up suitably [ for the purpose of conditions, such as whenever / mirror plane finish / of a format, cooling roller temperature, and a cooling roller front face /, ].

[0054] \*\* detecting the data of the thickness of a product and feeding back these data to a production process in the methodology production process of quality control, by adopting the measurement optical means of well-known and official business using a radiation, an electromagnetic wave, light, a supersonic wave, etc., -- the variation in the thickness of a product -- hand control -- or the quality can be controlled quality by automatic control. For example, the approach using the alpha-rays thickness gage of a transparency mold (absorption mold) or a dispersion mold, a beta ray thickness gage, and a gamma ray thickness gage as measurement optical means using a radiation is included, and the radioisotope of well-known and official business is used as a line source.

[0055] \*\* Set like a tail end process and the methodology tail end process like a fitter, or a fitter. Well DINGU, heat sealing, perforation grant, primer spreading, binder spreading, Drugs spreading, a parkerizing, vacuum evaporationo, sputtering, CVD, coating, It etches and spouts out. Dyeing, paint, electrostatic coating, air brushing, It laminates, sandwiches and embossing-endows and solid-pattern-endows, and die pressing can be carried out and after treatment, such as wave attachment, printing, an imprint, sanding, sand PURASUTO, stirring, punching, punching, honeycomb-structure-izing, corrugated fiberboard structuring, and layered product formation, and processing of finish can also be performed. According to the object, the approach of of well-known and official businesses, such as the calender method, an extrusion method, screen printing, gravure, a letterpress method, an intaglio method, a doctor blade method, dip coating, a spray method, an airabrasive technique, and electrostatic spray painting, is employable like a tail end process or a fitter. The film or sheet containing the lactic-acid system resin constituent concerning this invention can also be made into the layered product of multilayer structure by the sheet of other construction material, such as paper and other polymers, a lamination, lamination, etc.

[0056] \*\* In an extrusion method, the methodology extrusion method of the co-extruding method, or the co-extruding method, the die of well-known and official businesses, such as a single manifold die which combined a T die, an inflation die (circular die), a flat die, a feed block / single manifold die, and some feed blocks, can be used. these two or more polymers with which properties differ in the co-extruding method -- and -- or a multilayer film can be manufactured using an other type polymer. If a tubular film process or a balloon method is adopted, since a 2 shaft simultaneous drawing can be performed The strong product which has a low elongation percentage, a rate of high elasticity, and high toughness for high productivity Since it can manufacture cheaply relatively and a configuration is saccate (the shape of seamless), It is suitable for production of bags, such as a bag for preventing the water which dews the food pack of the low temperature of the takeout bag for supermarkets, frozen foods, prime meat, etc. wetting a perimeter, and a compost bag, or a bag. the lactic-acid system resin constituent concerning two or more this inventions from which a property differs by combining with the co-extruding method -- and -- or a multilayer film can be manufactured for high productivity using an other type polymer. It is also combinable with a tubular film process or a balloon method, and the co-extruding method. The film or sheet containing the lactic-acid system resin constituent concerning this invention can be manufactured by setting up process conditions according to the object to the shape of the shape of the shape of a roll, and a tape, and a cut sheet, tabular, and saccate (the shape of seamless).

[0057] \*\* Satisfying the film or sheet containing the lactic-acid system resin constituent concerning secondary-elaboration this invention in a polyhydroxy carboxylic-acid independent case can discover a difficult property. For example, in a polyhydroxy carboxylic-acid independent case, since drawdown nature is large, the width of face of selection of fabricating-operation conditions, such as working

temperature and a molding cycle, is relatively narrow. By contrast, in the case of the lactic-acid system resin constituent concerning this invention, since drawdown nature is small, the width of face of selection of fabricating-operation conditions, such as working temperature and a molding cycle, is relatively wide. So, the film or sheet containing the lactic-acid system resin constituent concerning this invention is a suitable ingredient also for the so-called fabricating which grants the being [ drawing processing blow processing, a vacuum forming, etc. / secondary ] and Miyoshi-or high order-configuration.

[0058] \*\* The film or sheet containing the lactic-acid system resin constituent concerning example this invention of an application A shopping bag, a garbage bag, a compost bag, a cement bag, a fertilizer bag, Food and the film for a confectionery package, a food-grade wrap film, the film for - horticulture for agriculture, Films for a magnetic tape cassette product package, such as a film for greenhouses, video, and an audio, It can be suitably used as the film for a floppy disk package, a fence, the oil fence for - lakes for - rivers for the oceans, adhesive tape, a tape, union material, a tarpaulin, bulk, tentorium, the bag for sandbags, a cement bag, a bag for fertilizer, etc. Moreover, by carrying out drawing processing of the film which extruded and created the polymer containing inorganic substances, such as a calcium carbonate, a barium sulfate, and titanium oxide, further, a porous film with permeability can also be obtained and it can be used for diaper covering, special wrapping, etc.

[0059] The seamless pipe which contains the lactic-acid system resin constituent concerning this invention by extrusion by [manufacture of seamless pipe] circular die can be manufactured. the lactic-acid system resin constituent concerning two or more this inventions from which a property differs by combining with the co-extruding method -- and -- or a multilayer seamless pipe can also be manufactured using an other type polymer.

[0060] The square bar and the round-head material which contain the lactic-acid system resin constituent concerning this invention by extrusion by [manufacture of square bar and round-head material] die can be manufactured. the lactic-acid system resin constituent concerning two or more this inventions from which a property differs by combining with the co-extruding method -- and -- or the square bar and the round-head material which have a multilayer-structure cross section can also be manufactured using an other type polymer. With combination with such a co-extruding method, the square bar and the round-head material which have the specific cross-section layer system and specific cross-section profile like for example, a golden Taro candy, the Naruto volume, and date rolls can also be manufactured.

[0061] [Foam]

"Foam" "foam" foam [ which is used in the claim and description of this application ] As stated to \*\*\*\*\* of the becoming word, \*\* To the concept of the becoming word Many openings (air bubbles, a void, a micro void, and a mold cavity are included) exist in the interior of resin. It is an opening phase (an opening the thing of continuation) in the continuous phase of resin with small apparent density gravity. an independent thing -- containing -- the general thing recognized to be the structures, such as a macromolecule which includes the resin structure which has the intermingled two phase structure or polyphase structure, for example, has cell structure, a foaming macromolecule, an expansion macromolecule, macromolecule foam, and macromolecule form, is included, and an elastic thing and a hard thing are included.

[0062] \*\* The foam containing the lactic-acid system resin constituent concerning manufacture this invention of foam can be manufactured by the approach of well-known and official business. For example, the foaming agent and foaming technique which are indicated by "MARUZEN macromolecule great dictionary-Concise Encyclopedia of Polymer Science and Engineering (the volume on Kroschwitz, the Mita supervision of translation, Maruzen, Tokyo, 1994)" and 811-815 pages can be used suitably. Moreover, according to regulation of the Montreal Protocol about the fluorine regulation for the so-called ozonosphere protection, \*\*\*\*, or the foaming agent and foaming technique of well-known and official business which cleared atmospheric control criteria can be used suitably. The properties of the continuity of the opening (air bubbles, a void, a micro void, and a mold cavity are included) of foam, an independence, magnitude, a configuration, distribution, and magnitude, such as homogeneity, are controllable by setting up foaming conditions suitably according to the object.

[0063] \*\* In a foaming agent foaming agent, decomposition includes the hydrocarbon which are inert gas, the chemical foaming agent which generates inert gas, and carbon numbers 3-5 or a chlorinated hydrocarbon, fluorocarbon, chlorofluorocarbon, water, nitrogen, LPG and LNG, a low-boiling point organic liquid, carbon dioxide gas, inert gas, etc. As an example of a chemical foaming agent, it is a sodium hydrogencarbonate, dinitrosopentamethylenetetramine, sulfonylhydrazide, an AZOJI carvone amide, p-tosyl semicarbazide, 5-phenyl tetrazole, diisopropyl hydrazo dicarboxy RAZE, the 5-phenyl -3, and 6-dihydro. - 1, 3, 4-OKISA diazine-2-ON, hydroxylation boron sodium, etc. are mentioned. As an example of a physical foaming agent, heptanes, such as hexanes [, such as pentanes /, such as n pentane, 2,2-dimethyl propane, and 1-pentene, n-hexane, 2-methyl pentane, 3-methyl pentane 2, and 2-dimethyl butane and a cyclohexane /, n-heptane, 2, and 2-dimethyl pentane, 2, 4-dimethyl pentane, 3-ethyl pentane, and 1-heptene, toluene, trichloromethane, tetrachloromethane, trichlorofluoromethane, a methanol, 2-propanol, isopropyl ether, a methyl ethyl ketone, etc. are mentioned. As an example of fluorocarbon, the chlorofluorocarbon of the CFC series of CFC-11, CFC-12, CFC-113, and CFC-114 grade is mentioned.

[0064] \*\* The foam containing the lactic-acid system resin constituent concerning general-purpose application this invention For example, a lunch box, tableware, the container of lunch which is sold at a convenience store, or a daily dish, The cup of a cup rahmen, a cup which is used with the automatic vending machine of a drink, TOROBAKO which is used in the container and tray for food, such as a fresh fish, prime meat, vegetables and fruits, tofu, and a daily dish, and a fresh fish commercial scene, Containers, such as a container for dairy products, such as cow's milk, and yogurt, a lactic acid bacteria beverage, and a carbonated drink, a soft drink, The container for alcoholic beverage drinks, such as Biel whiskey, a cosmetics container, a detergent container, The shock absorbing material for using it at the time of transport of electrical home appliances, such as a bleaching agent container, a heat insulation box, a flowerpot, a tape, television, and a stereo, The shock absorbing material for using it at the time of transport of precision instruments, such as a computer printer and a clock, It can be suitably used also as the shock absorbing material for using it at the time of transport of ceramics, such as shock absorbing material for using it at the time of transport of optical instruments, such as a camera, glasses, a microscope, and a telescope, and glass, pottery, protection-from-light material, a heat insulator, and a sound insulating material.

[0065] \*\* The foam containing the lactic-acid system resin constituent concerning a medical-application way and health application this invention can be used suitable for medical application or health. for example, dressings, the skin and the support for membrane for patches, a triangular handage, an adhesive bandage, a towel, and a disposable towel -- using -- throwing away -- getting wet -- the buttocks of a towel, a steamed towel, a dustcloth, tissue, the wetting tissue for - disinfection for clarification, and a baby -- the wetting tissue for \*\*\*\*, a disposable diaper, the object for physiology, and a vaginal discharge -- it can use suitable for the \*\* napkin a sanitary tampon, the tampon for blood absorption for - delivery for an operation, the covering stock material for health, a bag for sterilization, etc. The product these medical application or for health can carry out aseptic packaging after sterilization, sterilization, or disinfection by the approach of well-known and official business using germicides by the exposure of radiations, such as sterilization, sterilization by ethylene oxide gas, sterilization by hydrogen peroxide solution or ozone, sterilization by the exposure of ultraviolet rays or an electromagnetic wave, and a gamma ray, by heating or the steam, such as sterilization, ethanol, and a benzalkonium chloride, etc. moreover, the thing for which a process is installed into the clean bench and clean room which can supply super-clarification air by the laminar flow with a HEPA filter -- an aseptic condition -- and -- or a product can also be manufactured and packed in endotoxin and the free condition.

[0066] \*\* The foam containing the lactic-acid system resin constituent concerning a general industrial application and recreation application this invention can be used suitable for the recreation application which includes the general industrial application which includes agriculture, a fishing, forestry, industry, construction engineering-works business, and traffic traffic business and leisure, and a sport. For example, it can use suitably as cushioning materials for furniture, such as the cheesecloth for agriculture,

an oil absorber, weak-ground reinforcing materials, artificial leather, the lining cloth of a floppy disk, the bag for sandbags, a heat insulator, a sound insulating material, a cushioning material, a bed, and a chair, the cushioning material for floors, a packing material, union material, skid mud, the material for snowy roads, etc.

[0067] [Spinning]

"Yarn" "yarn" yarn [ which is used in the claim and description of this application ] As stated to \*\*\*\*\* of the becoming word, \*\* The concept of the becoming word The concept of the "raw thread" indicated by a fiber handbook and processing section (the edited by Society of Fiber Science and Technology, Japan, Maruzen, Tokyo, 1969), and 393-421 pages is also included. For example, a monofilament, multifilament, a staple fiber (staple fiber), A tow, a high bulk staple fiber, a high bulk tow, spun yarn, a union yarn, finished yarn, false twist yarn, a modified cross section fiber, a hollow filament, conjugate yarn, POY (partial orientation yarn) and DTY (drawing finished yarn), POY-DTY, a sliver, etc. are included.

[0068] \*\* Manufacture of yarn (spinning, silk manufacture)

The lactic-acid system resin constituent concerning this invention is a suitable ingredient for melt spinning and dry spinning. The lactic-acid system resin constituent concerning this invention by setting up suitably silk manufacture conditions, spinning conditions, knitting-and-weaving conditions, after-treatment conditions, dyeing conditions, and processing conditions according to the object It is processible into a size, a cross-section configuration, fineness (tex, a denier, yarn count, etc.), and desired yarn and the desired textile that have physical properties and properties, such as absorptivity, oil absorption property, dimension height, nerve, and aesthetic property, whenever [ thermal-resistance and crimp ] in tensile strength and an elongation percentage, and union strength more.

[0069] \*\* The lactic-acid system resin constituent concerning manufacture this inventions, such as a modified cross section fiber, multilayer-structure yarn, and a hollow filament The fiber which has hollow structure similar to the lumen structure which cotton has by designing a spinneret suitably according to the object, The fiber which has a core shell structure similar to the cuticle / CORTEX / medulla coaxial three-tiered structure which wool has, Spinning can be carried out suitable also for the fiber which has the cross section of the fiber which has conjugate structure similar to the bilateral structure which wool has, an anomaly which is represented by the triangle cross-section structure which silk has, or a polygon. the lactic-acid system resin constituent concerning two or more this inventions from which a property differs by carrying out spinning with a multilayer mouthpiece (a nozzle, orifice) - and -- or the yarn which has a multilayer-structure cross section can also be manufactured using an other type polymer. By such \*\*\*\*\* , the yarn which has a specific cross-section layer system and specific cross-section profiles, such as for example, a golden Taro candy, the Naruto volume, date rolls, and Baumkuchen, can also be manufactured.

[0070] By carrying out spinning with a mouthpiece (a nozzle, orifice) in the air, the hollow filament containing the lactic-acid system resin constituent concerning this invention can be manufactured. the lactic-acid system resin constituent concerning two or more this inventions from which a property differs by combining with \*\*\*\*\* -- and -- or a multilayer hollow filament can also be manufactured using an other type polymer. For example, the hollow filament which filled up the opening with the pigment can be applied to the textile which is not transparent even if it gets wet in water, the hollow filament which filled up the opening with liquid crystal can be applied to the textile from which a color tone changes with temperature, the hollow filament which filled up the opening with the ceramics or carbon black can be applied to the endoergic textile of far-infrared absorptivity, or the hollow filament which filled up the opening with lead can also be applied to the fishing net which sinks in water.

[0071] \*\* In a process-planning silk manufacture process, it can set up suitably [ for the purpose of conditions, such as the configuration and format of a spinneret, draw magnification, a drawing number of stages, heat treatment temperature, a change rate of heat treatment temperature, crimp endowment, and oils processing, ].

\*\* The filament containing the lactic-acid system resin constituent concerning this invention which has desired fineness from a pole microfilament which is equal to the fiber which constitutes product

EKUSENU (a trademark, Toray Industries), or fiber thinner than it to super-\*\*\*\* fiber which is equal to the size of \*\*\*\* for fasteners, or fiber thicker than it can be manufactured suitably.

[0072] [Manufacture of a textile]

\*\* As stated to \*\*\*\*\* of the becoming word, include the general thing recognized to be fiber structure objects, such as textile fabrics, knitting, a nonwoven fabric, the braid containing a string or a rope, a curdy high bulk staple fiber, a sliver, porosity sponge, felt, paper, and a network, to the concept of the word a "textile" "textile" textile [ which is used in the claim and description of this application ] Becoming.

\*\* the weaving machine of the manufacture well-known and official business of textiles, and shuttle loess -- by using a weaving machine (a water jet loom, air jet loom), filament yarn textiles, spun-yarn textiles, stretch textiles, and industrial materials textiles can be manufactured.

[0073] \*\* Knitted fabric, weft knitting, round-braid, warp knitting, tricot, round-braid socks, seamless socks, and tricot socks, a ball race, a braid, and \*\*\*\* can be manufactured using the knitting machine of manufacture well-known and official businesses, such as knitting, a braid, and \*\*\*\*.

\*\* the staple fiber containing the lactic-acid system resin constituent concerning manufacture this invention of a staple fiber (staple fiber) -- other natural fibers and a synthetic fiber -- and -- or it is also mixable by the staple fiber of a semi-synthetic fiber, the mixing ratio of arbitration, and the staple diagram of arbitration. The staple fiber containing the lactic-acid system resin constituent concerning this invention can be suitably used also as the raw material of paper, the filler for composite material, the whisker for composite material (cat whisker), and fiber for FRP restoration.

[0074] \*\* The nonwoven fabric containing the lactic-acid system resin constituent concerning manufacture this invention of a nonwoven fabric can be manufactured by the approach of well-known and official business. The manufacturing method indicated by "MARUZEN macromolecule great dictionary-Concise Encyclopedia of Polymer Science and Engineering (the volume on Kroschwitz, the Mita supervision of translation, Maruzen, Tokyo, 1994)" and 906-910 pages is suitably employable as manufacture of the nonwoven fabric containing the lactic-acid system resin constituent concerning this invention. manufacture of the nonwoven fabric containing the lactic-acid system resin constituent concerning this invention -- for example, the dry type-card method, the heat pasting-up method, the air array method, a wet method, the span bond method, the melt blowing method, the micro fiber method, and a stream -- a confounding method, the needle punch method, a laminated layers method, the stitch-bonding method, a paper-making method, etc. are suitably employable. The nonwoven fabric containing the lactic-acid system resin constituent concerning this invention Like a SHINSA rate (a trademark, three em) or a nonwoven fabric like Isaac (a trademark, Teijin) by which Kamiichi is carried out. Although a steam like GOATEKKUSU (a trademark, Junkosha, drawing fine porosity polytetrafluoroethylene (PTFE)) or the Espo R (a trademark, Mitsui Toatsu Chemicals) by which Kamiichi is carried out is penetrated By combining with a tarpaulin which is not made to penetrate, water is applicable to protection-against-the-cold / water proof dress (the object for mountain climbing, for skiings, etc.).

[0075] \*\* The textile containing the lactic-acid system resin constituent concerning application this invention of a textile The tunica for the object for common garments, or medical-application garments, working clothes, an operating gown, a pajamas, underwear, An underwear, lining cloth, a hat, a mask, dressings, a triangular handage, the Sox, the stocking for women, The foundations for women (a brassiere, shorts, etc.), a panty hose, Tights, socks, \*\*\*\*, a glove, working gloves, a towel, gauze, a towel, a carpet, A mat, a curtain, wallpaper, a clothes core material, the inner package material for automobiles, a mattress, It can use suitable for a bag, a Japanese wrapping cloth, bedding, bedding cotton, a pillow case, a blanket, a sheet, a protection-against-the-cold wear heat insulator, a ball race, a tape, composition or artificial artificial leather, composition, an artificial artificial fur and composition, artificial artificial suede and composition or an artificial artificial leather, a reticulated pipe, etc. The textile containing the lactic-acid system resin constituent concerning this invention can be used suitable for medical application or health. for example, the suture for surgical operations, dressings, a triangular handage, an adhesive bandage, a towel, and a disposable towel -- using -- throwing away -- getting wet -

- the buttocks of a towel, an office roll towel, a steamed towel, a dustcloth, tissue, the wetting tissue for - disinfection for clarification, and a baby -- the wetting tissue for \*\*\*\*, a disposable diaper, disinfection cotton, the object for physiology, a vaginal discharge -- it can use suitable for the \*\* napkin, a sanitary tampon, an undershirt pad, the tampon for blood absorption for - delivery for an operation, the covering stock material for health, a bag for sterilization, the network for kitchen garbages, a garbage bag, etc.

The product these medical application or for health can carry out aseptic packaging after sterilization, sterilization, or disinfection by the same approach as the case of the above-mentioned foam. moreover, the same approach as the case of the above-mentioned foam -- an aseptic condition -- and -- or a product can also be manufactured and packed in endotoxin and the free condition.

[0076] The textile containing the lactic-acid system resin constituent concerning this invention can be used suitable for the recreation application which includes the general industrial application which includes agriculture, a fishing, forestry, industry, construction engineering-works business, and traffic traffic business and leisure, and a sport. For example, the cheesecloth for agriculture, a insect control bird net, a screen, a fishing line, a fishing net, a cast net, A longline, an oil absorber, a network, a rope, a rope, a sail (sail cloth), a hood, a tarpaulin, Thailand Cong, a container bag, an industrial visiting bag, a cement bag, a fertilizer bag, filter media, The water penetration cloth for reclamation work, the cloth for weak-ground reinforcement, artificial leather, the felt for paper making, It can use suitably as the lining cloth of a floppy disk, tentorium, the bag for sandbags, the network for afforestation, a heat insulator, a sound insulating material, protection-from-light material, impact shock absorbing material, a cushioning material, union material, skid mud and the material for snowy roads, a network-like pipe, an engineering-works structural drain hose, etc. In the above-mentioned impact shock absorbing material, the shock absorbing material for using it at the time of transport of ceramics, such as shock absorbing material for using it at the time of transport of optical instruments, such as shock absorbing material for using it at the time of transport of precision instruments, such as shock absorbing material for using it at the time of transport of electrical home appliances, such as television and a stereo, and a computer printer, a clock, and a camera, glasses, a microscope, a telescope, and glass, pottery, is also included.

[0077]

[Example] Although an example is given to below and this invention is explained concretely, unless the technical range of this invention is crossed, it is not limited to this. It measured by the approach of showing the weight average molecular weight (Mw) of polylactic acid system resin, the melting tension in an example (MT value), and flexibility (elongation) below.

[0078] \*\* Weight average molecular weight (Mw)

It measured with gel permeation chromatography (GPC) by making polystyrene into a criterion. A Measuring condition is described below.

GPC:Shodex System 11 (Showa Denko make)

The column used: K-805Lx2, K-800P (precolumn)

column temperature: -- 40-degree-C solvent: -- chloroform rate-of-flow: -- 1.0 ml/min sample concentration: -- 3mg / amount of 1ml sample placing: -- 100microl [0079] \*\* Melting tension (MT value)

After measuring a melt flow index at two suitable temperature using 2160g of loads, from the temperature-melt-flow-index-plot, the melt flow index searched for the temperature used as 10g / 10 minutes, and measured melting tension in the temperature. the detail of the methodology -- for example, a "plastics-processing-technology handbook" (edit; -- the Society of Polymer Science, Japan --) Issuance; 1414-1416 pages of Nikkan Kogyo Shimbun, "PROPERTIES OF POLYMERS - THEIR CORRELATION WITH CHEMICAL STRUCTURE;THEIR NUMERICAL ESTIMATION AND PREDICTION FROM ADDITIVE GROUP CONTRIBUTIONS - THIRD, COMPLETELY REVISED EDITION" (author; D.W.VAN KREVELEN, issuance;ELSEVIER, 1990) It is indicated by 686-687 etc. pages etc.

[0080] \*\* The heat press of an elastic modulus and the lactic-acid system resin constituent which might be extended was carried out, and the press film with a thickness of 100 micrometers (\*\*5) was produced. From a press film to JIS It pierced in a \*\*\*\* cutting load and an elongation test piece

configuration given in K6732. Using this test piece, the tension test was performed using the straw graph M mold, and an elastic modulus and elongation were measured. In addition, elongation was computed by the following formulas.

[A-one number]

It is as [ that it is the distance between the marked lines before the distance between the marked lines / trial after an elongation (%) = trial ] follows [ test condition ].

distance between chucks: -- distance between 7cm marked lines: -- 4cm speed-of-testing: -- 200 mm/min [0081] [Example 1 of manufacture] L-lactide 400g and first tin of octanoic acid 0.04g, and lauryl alcohol 0.12g were enclosed with the thick polymerization container made from cylindrical stainless steel equipped with the agitator, and was deaerated under vacuum for 2 hours. After nitrogen gas permuted, heating churning was carried out by 200 degrees C / 10mmHg for 2 hours. Air cooling of the melt of polylactic acid was extracted and carried out from lower output port after reaction termination, and it cut in the pelletizer. The obtained polylactic acid was the yield of 340g, 85% of yield, and weight-average-molecular-weight (Mw) 138,000. Melting tension was 0.6g.

[0082] 45g was inserted in the reactor which installed the [example 2 of manufacture] Dien-Stark trap 90% in 10kg of L-lactic acid, and the end of tin, and after making water distill, agitating by 150 degrees C / 50mmHg for 3 hours, by 150 degrees C / 30mmHg, it agitated for further 2 hours and oligomerized. Diphenyl ether 21.1kg was added to this oligomer, the water separator separated the water and the solvent which distilled by performing 150 degrees C / 35mmHg azeotropy dehydration, and only the solvent was returned to the reaction machine. After letting the organic solvent returned to a reaction machine pass in the column filled up with 4.6kg molecular-sieve 3A, as it returned to the reaction machine 2 hours after, the reaction was performed by 130 degrees C / 17mmHg for 20 hours, and the polylactic acid solution of weight-average-molecular-weight (Mw) 150,000 was obtained. After adding and diluting diphenyl ether 44kg which dehydrated in this solution, it cooled to 40 degrees C and the depositing crystal was \*\*\*\*(ed). 0.5 N-HCl12kg and ethanol 12kg were added to this crystal, after stirring at 35 degrees C for 1 hour, it \*\*\*\*(ed), and it dried by 60 degrees C / 50mmHg, and 6.1kg (85% of yield) of polylactic acid powder was obtained. This powder was fused and pelletized with the extruder and polylactic acid was obtained. The weight average molecular weight (Mw) of this polymer was 147,000. Melting tension was 0.6g.

[0083] Except having used 10kg of 6-hydroxy caproic acids instead of [example 3 of manufacture] L-lactic acid, it reacted by the same approach as the example 2 of manufacture, and 7.1kg (82% of yield) of the poly caprolactone powder was obtained. Weight average molecular weight (Mw) was 150,000. Melting tension was 0.7g.

[0084] Except having used 1,4-butanediol 4.33kg and 5.67kg of succinic acids instead of [example 4 of manufacture] L-lactic acid, it reacted by the same approach as the example 2 of manufacture, and 6.6kg (80% of yield) of polybutylene succinate powder was obtained. Weight average molecular weight (Mw) was 141,000. Melting tension was 0.6g.

[0085] [Examples 1-6], the [examples 1-5 of a comparison]

As shown in a table 1, the polylactic acid obtained by the example 1 of manufacture and/or 2, aliphatic series polyester, and organic peroxide were mixed using the Henschel mixer, and it pelletized by carrying out melting kneading using a single screw extruder. The cylinder temperature was 170-200 degrees C. The weight average molecular weight (Mw) of the obtained resin, a melt flow index, and melting tension were measured. Moreover, the heat press of the pellet was carried out in the range with a temperature of 190-200 degrees C with the press machine, and the press film was produced. The thickness of a film was 100 micrometers (\*\*5 micrometers). The test-piece-for-tensile-test configuration was pierced from the obtained film, and elongation was measured. The result was summarized in a table 1.

[0086]

[Raw material used for the experiment] PLA1: Polylactic acid of the example 1 of manufacture Mw138,000 PLA2: Polylactic acid of the example 2 of manufacture Mw147,000 PCL1: Poly caprolactone of the example 3 of manufacture Mw150,000 PCL2: Cel green PH7 (a trade name, Daicel

Chemical Industries make)

Mw 70,000 PSB1: Polybutylene succinate of the example 4 of manufacture Mw141,000 PSB2: Bionolle #1020 (a trade name, Showa High Polymer make)

Mw105,000 [0087]

[Table 1] An example 1 - 6 ----- fruit (A) component; macromolecule \*\*\*\*\* ----- (B) component;

Example (a-1) (a-2) Organic peroxide Melting Elastic modulus Elongation Polylactic acid Aliphatic series polyester Tension [Weight section] [Weight section] [Weight section] [g], [MPa], [%]

----- 1 PLA1 PCL1 PO-1 8.2 1200 230 The 100 weight sections 50 weight sections The 0.5 weight sections ----- 2 PLA2 PCL1 PO-1 11 1000 300 The

100 weight sections The 100 weight sections The 0.5 weight sections ----- 3

PLA2 PCL2 PO-1 12 1000 The 260100 weight sections The 100 weight sections The 0.5 weight

sections ----- 4 PLA2 PSB1 PO-1 18 850 350 The 100 weight sections The 100

weight sections The 0.5 weight sections ----- 5 PLA2 PSB2 PO-1 2.5 1500

200100 weight sections 30 weight section The 0.5 weight sections ----- 6 PLA2

PSB1 PO-1 0.8 880 210100 weight sections 100 weight section The 0.1 weight sections -----

----- legend :P O-1; 1, 3-bis(t-butyl dioxy) (isopropyl) benzene (par butyl P)

It is a numeric value [ as opposed to / in the weight section of the organic peroxide of a KISAN (B) component / the macromolecule component 100 weight section of the (A) component to PO-2;2, the 6-dimethyl -2, and 5-screw (tert-butyl peroxide) ].

[0088]

[Table 2] The example 1 of a comparison - 6 ----- ratio (A) component; macromolecule \*\*\*\*\* ----- (B) component;

Example (a-1) (a-2) Organic peroxide Melting Elastic modulus Elongation Polylactic acid Aliphatic series polyester Tension [Weight section] [Weight section] [Weight section] [g], [MPa], [%]

----- 1 PLA2 PCL2 It carries out. 0.6 1000 90 The 100 weight sections The 100 weight sections ----- 2 PLA2 PSB2 It carries out. 0.6 1300 120 The 100 weight

sections The 100 weight sections ----- 3 PLA2 It carries out. PO-1 5.0 2000 10

The 100 weight sections The 0.5 weight sections ----- 4 PLA2 PCL2 PO-1

Gelation Gelation The 100 weight sections The 100 weight sections Six weight sections

Measurement impossible measurement is impossible. Measurement impossible -----

----- 5 PLA2 PSB2 PO-1 Gelation Gelation Gelation 100 weight section 100 weight section Six weight sections Measurement is impossible. Measurement is impossible -----

----- legend :P O-1; 1, 3-bis(t-butyl dioxy) (isopropyl) benzene (par butyl P)

It is a numeric value [ as opposed to / in the weight section of the organic peroxide of a KISAN (B) component / the macromolecule component 100 weight section of the (A) component to PO-2;2, the 6-dimethyl -2, and 5-screw (tert-butyl peroxide) ].

[0089]

[Effect of the Invention] Flexibility and melting tension of an obtaining-by this invention polylactic acid system resin constituent are improving. Furthermore, it is the approach of acquiring with an extruder in a short time.

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[Translation done.]

## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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CLAIMS

## [Claim(s)]

[Claim 1] Polylactic acid [a component (a-1)] and aliphatic series polyester [the resinous principle [(A) component which comes to contain component (a-2)]], It is the polylactic acid system resin constituent obtained by carrying out melting kneading of the organic peroxide component [(B) Component] in a 150-250-degree C temperature requirement. The presentation ratio of polylactic acid [a component (a-1)] and aliphatic series polyester [a component (a-2)] and organic peroxide component [(B) component] is based on the polylactic acid [component (a-1)] 100 weight section. aliphatic series -- polyester -- [ -- a component (a-2) -- ] -- ten - 300 -- weight -- the section -- organic peroxide -- a component -- [ -- ( -- B -- ) -- a component -- ] -- 0.01 - five -- weight -- the section -- it is -- Polylactic acid [a component (a-1)] is weight average molecular weight 30,000-Mw 500,000. The polylactic acid system resin constituent with which aliphatic series polyester [a component (a-2)] is characterized by being weight average molecular weight 30,000-Mw 500,000, an elastic modulus 50 - 1000MPa, and 20 - 2,000% of elongation.

[Claim 2] The polylactic acid system resin constituent which is at least one sort chosen from the group which aliphatic series polyester [a component (a-2)] becomes from the copolymer of the poly caprolactone, polybutylene succinate, polyethylene succinate, and a hydroxybutyric acid and a hydroxy valeric acid and which was indicated to claim 1.

[Claim 3] \*\* For 0.7-20 [g], and \*\* elastic modulus, 50-1,500 [MPa], and \*\* elongation are [ the melting tension in a melt flow index 10 [g / 10 minutes] ] 100-2,000 [%].

The polylactic acid system resin constituent which comes out and exists and which was indicated to claim 1 or 2.

[Claim 4] Polylactic acid [a component (a-1)] and aliphatic series polyester [the resinous principle [(A) component which comes to contain component (a-2)]], It is the manufacture approach of the polylactic acid system resin constituent which carries out melting kneading of the organic peroxide component [(B) Component] in a 150-250-degree C temperature requirement. The presentation ratio of polylactic acid [a component (a-1)] and aliphatic series polyester [a component (a-2)] and organic peroxide component [(B) component] is based on the polylactic acid [component (a-1)] 100 weight section. aliphatic series -- polyester -- [ -- a component (a-2) -- ] -- ten - 100 -- weight -- the section -- organic peroxide -- a component -- [ -- ( -- B -- ) -- a component -- ] -- 0.01 - five -- weight -- the section -- it is -- Polylactic acid [a component (a-1)] is weight average molecular weight 30,000-Mw 500,000. The manufacture approach of a polylactic acid system resin constituent that aliphatic series polyester [a component (a-2)] is characterized by being weight average molecular weight 30,000-Mw 500,000, an elastic modulus 50 - 1000MPa, and 20 - 2,000% of elongation.

[Claim 5] The manufacture approach of the polylactic acid system resin constituent indicated to claim 4 which is at least one sort chosen from the group which aliphatic series polyester [a component (a-2)] becomes from the copolymer of the poly caprolactone, polybutylene succinate, polyethylene succinate, and a hydroxybutyric acid and a hydroxy valeric acid.

[Claim 6] \*\* The manufacture approach of the polylactic acid system resin constituent which the melting tension in a melt flow index 10 [g / 10 minutes] indicated to claim 4 whose range and \*\*

elongation of 50-1,500 [MPa] 0.7-20 [g], and \*\* elastic modulus are 100-2,000 [%], or 5.

[Claim 7] Mold goods which come to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

[Claim 8] The film which comes to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

[Claim 9] The tubular blown film which comes to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

[Claim 10] Foam which comes to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

[Claim 11] The layered product which is a layered product which comes to contain a resin layer and a base material layer, and is the thing in which said resin layer comes to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

[Claim 12] The paper lamination product which is a paper lamination product which comes to contain a resin layer and paper, and is the thing in which said resin layer comes to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

[Claim 13] The aluminum lamination product which is an aluminum lamination product which comes to contain a resin layer and an aluminum layer, and is the thing in which said resin layer comes to contain the polylactic acid system resin constituent indicated they to be [ any / claim 1 thru/or / of 3 ].

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[Translation done.]